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Review Article

EMBEDDED ASSISTIVE STICK FOR VISUALLY IMPAIRED PEOPLE

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ABSTRACT
Today's technology is improved to a greater extent for the betterment of people, but there are some people with disabilities like blindness. In order to overcome their problem a smart stick is designed with GPS-GSM module, ultrasonic sensor that would help them in their way to identify obstacle. Ultrasonic sensors calculate the distance of the obstacles around the visually impaired person to guide the user towards the necessary path. This paper describes about how each components would help them. This also helps to find the stick if it is lost. The tool says that, the smart walking stick that alerts visually-impaired persons over obstacles, fire, and water and could help them in walking with less accident.

Keywords: *Ultrasonic sensor, Moisture sensor,GPS , GSM , Light sensor.*

INTRODUCTION
Vision is most important because 83% of information human gets from the environment is by sight. There are approximately 37 million visually impaired people across the globe and over 15 million are from India. Even for the non-visually impaired people, the clogging of obstacles is sometimes difficult. People with visual ailments are dependent on external help which can be provided by humans, trained dogs, or special electronic devices. Existing devices for visually impaired are able to detect and recognize objects that lie on the path, but a considerable risk includes the objects that are at a depth, or obstacles above waist level. Thus we were motivated to develop a smart embedded assistive stick to overcome these restrictions. The system,we propose provides spurious vision, object detection and real time assistance via global positioning system (GPS). The overall aim is to provide a low cost and efficient navigation aid for visually impaired.The system uses Ultrasonic sensor, temperature sensor, humidity sensor, GPS receiver, Vibration sensor, RF module, microcontroller and Battery. The most common tool used by these people is the Guide cane. We decided to modify and enhance the Guide cane, since they are only able to detect objects by touch or by cane. The user cannot identify the obstacle correctly. We overcome this difficulty by adding ultrasonic sensors at specific positions of the stick that provided information about the environment to the user through vibration feedback. There are various modules used here like, ultrasonic sensor, RF module etc. As result this system helps the visually impaired to have a sense of vision.

Block Diagram
The block diagram of the proposed embedded assistive stick for visually challenged is shown in the figure 3.1 below.

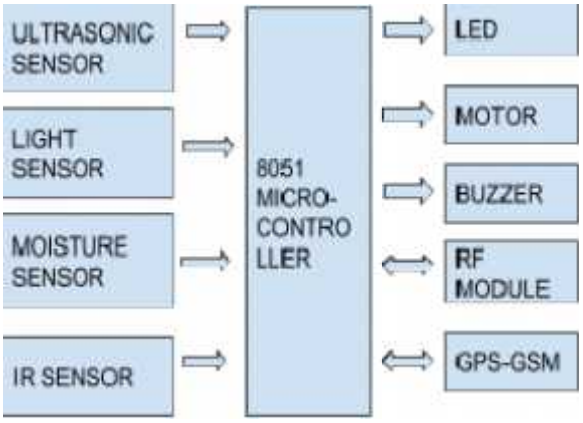

Fig.1: Block diagram of embedded assistive stick

Related Works
This section furnish information about works done for the visually impaired persons. S. Gangwar designed a smart stick for blind using IR sensors that would give warning about the obstacle. Vibrating signals are used as an alert if, obstacle is detected. In the instances of unexpected situations this will not be suitable, as it focuses only on

obstacle detection. Another drawback is that, the IR sensor can sense only for short distance and hence this is ineffective. To move safely without any difficulties Guide Cane is used. By the presence of vibration motor and servo motor the guide cane becomes heavier. Ultrasonic sensors are integrated with guide cane,which gives effective detection of obstacles. The limitation of GuideCane is its heavy handling. Central Michigan University students have designed the smart cane where frequency Identification (RFID) is used .To assist the users to move, RFID tags are placed in so many areas. Even though it similar a normal stick,it is necessary that user wears a bag. The user is informed about the obstacles through the speakers in the bag which provides electricity power. United Nations agency have come up with a special gloves where it produces different vibrations in each finger. This have many limitations as it is suitable only for small areas. Laser sensors have been used by Benjamin etal to detect the obstacles. The limitations of this system is that users are not guided here, instead it gives only the beep sound. Nottingham obstacle detector is another type, that uses ultrasound.

Proposed work

The embedded assistive stick for visually impaired persons is an innovative stick designed for visually impaired people for improved navigation. We have proposed a blind stick that allows visually impaired people to navigate easily using this technology. This stick is attached with ultrasonic sensor along with light and moisture sensors. Here ultrasonic sensors to detect obstacles using ultrasonic waves. If the obstacle is sensed, the sensor passes this data to the microcontroller. The distance is calculated based on the data sent to the microcontroller. Based on the obstacle detection the buzzer alters the user. It detects and sounds another buzzer if it detects water and alerts the visually disabled. IR sensors are placed at the end of the stick. Another feature used here is light sensor, which helps the visually impaired to know whether it is day or night. A wireless RF module is used to locate the stick, if lost. A remote i.e RF transmitter is given to the impaired people and RF receiver is placed in the stick.GSM and GPS are used to locate the person. A tactile switch is attached to the stick. If it is pressed GSM sends the message to the guardian. On whole, this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

Description

Ultrasonic sensor

Fig.2: Ultrasonic sensor

In order to detect the obstacle like walls or staircase ultrasonic sensors are used here. Distance measurement is done by this sensor. For both reception and emission ultrasonic sensors uses a single element. A 40 kHz frequency sound waves are transmitted from the sensor. This sensor has a transducer to receive an echo and send pulses. The distance of an object is determined by calculating the time interval between the transmitted signal and received echo. Light, color and other factors will not affect this sensor.

Ir Sensor

Fig.3: IR sensor

IR sensors are placed at the bottom of the stick to detect any hurdles, or small obstacles found over the pathway of the user. The IR sensor consists of IR transmitter and IR receiver. IR Transmitter is a light emitting diode (LED) which emits infrared radiations which is not visible to the human eye. IR receivers comes in the form photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. When the phototransistor receives any infrared radiation, current flows through it and MOSFET in the sensor turns on. This lights up the LED which acts as a load. The potentiometer controls the sensitivity of the phototransistor.

Moisture Sensor

Fig.4: Moisture sensor

The presence of water is detected by Moisture sensor. Existing systems failed to detect the detect the water in the soil, rather it detected only the obstacles. So, in order to overcome this drawback, our proposed system uses moisture sensor at the tip of the stick. The sensor is kept in a way that the whole sensor doesn't get immersed in water and gets short circuited. Moisture sensor senses the presence of water level in the soil and indicates the microcontroller about the presence of water sources such as pond,river ,lake ,ditch ,sea ,etc.

Gps And Gsm Module

Fig.5: GSM module

To measure time and position GPS satellites uses ground stations and constellation of satellites. By collecting the different pieces of information from each satellite GPS receivers calculate time and position. This module provides the current time, date, latitude, longitude, speed, altitude and travel direction / heading among other data, and can be used in lot of applications like navigation, tracking systems GSM is a 2G communication. FDN, SMS, ISDN etc are some of the features of GSM. GSM is attached with button for sending message. Message passing,receiving calls are managed by AT commands.RS232 is connected to micro-controllers and computers for combine this module.

Dc Motor

Fig.6: DC motor

DC motor converts electrical energy into mechanical power. To change the direction of current flow periodically, DC motors have some internal mechanisms. The first type to beused is DC motors. By using variable supply voltage or by changing the strength of current in field windings, DC motor's speed can be controlled. In tools, toys and appliances small type of DC motor's are used. Alternating current or direct current is used by universal motor. For portable power tools light weight motors are used. In propulsion of electric vehicles and elevators larger DC motor's are used. By replacing DC motors with AC motors emergence of power electronics is possible. DC motors are mainly used here to produce vibration sensing to the visually impaired persons. The advantages of DC motor is that, by acceleration and deceleration speed is controlled.

Light Sensor

Fig.7: Light sensor

Light sensors convert photons into electrons. In this paper light sensors are used to detect the presence or absence of light. The common type of light sensors used are LDR. The output from light sensor

controls the buzzer sound. Light sensors comes under photo electric devices. Alarm clock,, burglar alarm circuits are the applications of this sensor. Photo-emissive cells, Photo- conductive cells, Photo-voltaic cells, Photo-junction devices are the main classification of this sensor.

Table 1: Distance of the obstacle from the ultrasonic sensor

DISTANCE (in cms)	TIME(sec)	TYPE OF SIGNAL
350	2.0	Very low volume Beeps
300	1.9	Very low volume Beeps
250	1.6	low volume Beeps
200	1.4	low volume Beeps
150	1.0	Moderate Beeps and Vibrations
125	0.9	Moderate Beeps + Vibrations
100	0.7	High volume Beep+ Vibrations
80	0.5	High volume Beep+ Vibrations
60	0.3	Very High volume Beep+ Vibrations
40-50	0.1	Very High volume Beep+ Vibrations
20-30	0.05	Continuous Vibrations
5-10	-	Continuous Vibrations

Rf Module

The RF transmitter and RF receiver are the main components of RF module. Encoder/decoder are often used along with RF trans receiver pair. Transmitter uses encoder and receiver uses decoder. The transmitter and receiver has four and eight pins respectively. This RF transreceiver is used to find the stick if it is lost. Amplitude shift keying is the modulation used here. The range of transmission and reception can adjusted according to the needs. This module works at radio frequency. Line of sight is not required here, and it is the advantage of this module. Vehicle monitoring, robot remote control etc are some of the useful applications of this module.

Buzzer

To alert the user about the obstacle detected buzzer is used. In case of any clash, or to point out that obstacle is near to user, the buzzer is used. A vibration sensor along with buzzer is used to alert the user. Piezo buzzers are used here. The main advantages of piezo buzzers are low cost, light weight, and simple construction and are widely used. In between two conductors, piezo crystals are placed. Inside conductors they have push and pull effect when potential is applied. They produces sound in range of 2-4 khz.

Results

This study has experimented on how well the Cane works for the visually impaired. This paper gives information about different modules and how well it is used.

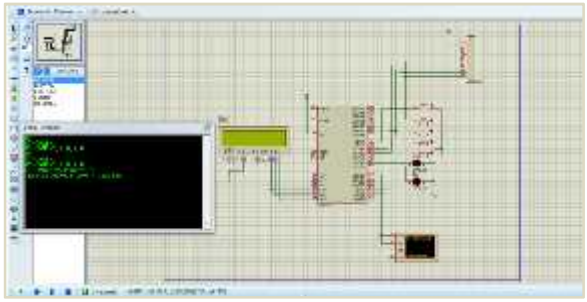

Fig.8: Simulation output of GSM module

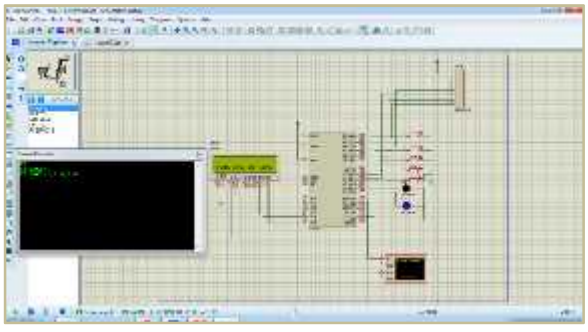

Fig.9: Simulation output of moisture sensor

Conclusion

Based on the difficulties in existing cane, this paper proposes an advanced assistive stick for visually impaired persons using technology like Ultrasonic

waves, IR radiations, GPS,GSM ,moisture sensor and light sensor. In addition to that, we have used RF module for finding the smart stick itself. Also, this paper aims to evolve emergency trigger alert system along with design.

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